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A Study on Reformulation of Ginger-based Traditional Drink based on Consumer Acceptability and Flavor Preference

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Abstract

This research aimed to reformulate a Ginger-based Traditional Drink (GTD), traditionally consumed in Indonesia based on a consumer acceptance and flavor attribute preference. This study was conducted in Bogor, Indonesia. The research was divided into three steps, i.e. selection of GTD, optimization of the formula of selected GTD by Mixture Design in Design Expert 7.0 software, and final determination of physicochemical properties and acceptability of the optimized GTD. Fishbein and Wilcoxon's tests were applied as a processor in analyzing the data obtained from questionnaires. The preference study showed that "bajigur" was the most favored GTD in which ginger pungency was found as the most important attribute. The usage of brown sugar, ginger, and coffee as ingredients significantly contributed to the preferences in product color, sweetness, and pungency but not in aroma. The reformulated GTD could be accepted by consumers from varied ethnics (Batavians, Javanese, Sumatrans, Celebes, and Sundanese), although the majority was still from the Sundanese ethnic (67%). The optimized GTD formula was more preferred than the commercial "bajigur" with the hedonic scores of 3.44 and 1.25, respectively.

Keywords

Traditional Ginger-based Drink; Consumer Acceptance; Sensory; Reformulation; Flavor

Introduction

Ginger (*Zingiber officinale* Rosc) is a medicinal plant well-known in national, regional, and international market. Its ability to give a trigeminal impact "warm feeling" and the pleasant flavor characteristic are outstanding properties of ginger. Therefore, ginger is widely used as an ingredient in several recipes of Indonesian traditional drinks [1]. Ginger-based drinks have been known since long time ago in Indonesia and spread all over Indonesia with different names such as *wedang jahe* (ginger tea), *bajigur, sekoteng, bandrek, serbat* and *bir pletok*.

Indonesian ginger-based traditional drinks were previously reported to exert antioxidant effects [2]. However, study concerning their consumer preferences is rather scarce; thus, there is clearly a need to conduct a research focusing on identification of acceptability level of ginger-based traditional drinks by consumers. Since sensory attribute of a food is the main factor in determining its acceptability by consumers; hence, the acceptability of the ginger-based traditional drinks should be determined by using sensory test.

Preference and acceptability of food are influenced by intrinsic and extrinsic factors [3], which also affected ginger-based traditional drinks. The use of different ingredients in the drinks according to their origin and various processing parameters may alter their taste and aroma [4]. Moreover, demographic factors, such as social status, experience, knowledge, gender, age, and psychological state also influence sensory acceptability of the consumer [5].

Several researches on ginger-based traditional drinks have been made, which focus mostly on production technology and nutritional content [2], but studies pertaining their sensory acceptability seem to be still limited. Therefore, this research aimed to evaluate the sensory and flavor acceptability of available ginger-base traditional drinks by the consumer, while also observing the role and impact of certain ingredients frequently used in their production to the flavor attributes. Based on current reports, a modified formula of ginger-based traditional drinks will be developed. The available information will be further used as a basis to develop ginger-based traditional drinks according to consumer preference.

Materials and Methods

Materials

Main ingredients included ginger, coconut milk, palm sugar, while other materials used were coffee, salt, and pandanus leaves. These ingredients were purchased in Pasar

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Anyar Bogor, while ginger was obtained from BALITTRO (Indonesian Medicinal and Aromatic Crops Research Institute/Balai Penelitian Tanaman Obat dan Aromatik) Bogor. Different ginger-based traditional drinks, i.e. *sekoteng, bandrek, wedang jahe, sarabba* and *bir pletok,* were used, whereas commercial *bajigur* purchased from street vendor in Bogor was regarded as a reference in consumer's acceptability and preference. The experimental equipments included colorimeter (CR-310 *Minolta Chromameter*), pH meter (Hanna Hi8014), Soxhlet extraction apparatus, distillation apparatus and glassware.

Methods

Preference Analysis of Available Ginger-based Traditional Drinks (GTDs)

Questionnaire design and evaluation: Questionnaire was used as a survey instrument to determine which GTDs would be used in further experiment. The questionnaire included product description and general information of the respondent and contained 2 types of question, i.e. open and close questions. Thus, validity and reliability tests using 30 respondents were carried out to validate the questionnaire prior to use.

Location and respondent selection: The consumer's acceptability and preference test for ginger-based traditional drink (GTD) was conducted in Bogor, Indonesia. Respondents of this study were consumers in Bogor. They were selected using purposive sampling [6], while the eligible respondents for selecting GTD were untrained panelists who consumed GTD at least once in the last two months. Another criterion of the respondents was their ethnic, including Batavians, Javanese, Sumatrans, Borneo/Celebes, and Sundanese.

Data collection: Data were collected by survey method [6] for 40 respondents. The type of data collected was primary data from the questionnaire using written interview.

Data analysis: The survey data for each GTD were analyzed to determine the most preferable product, indicated by the highest consumption frequency. The formula in the selected product was then chosen as a basis for the product reformulation.

Fishbein method was used to analyze data, which score of b_i and e_i ranging from -2 to +2. These scores were then calculated according to the utilized attributes. The formula of Fishbein method can be expressed as:

$$A_0 = \sum_{i=1}^{n} b_i e_i$$

Where: A_0 = the attitude toward various GTD product attributes

b_i = strength of belief attribute i about object

e_i = evaluative aspect of B about attribute i

n = the number of beliefs

GTD Formula optimization

The reformulated GTD was selected according to questionnaire evaluation in the first stage, focusing on the highest preference score (hedonic) in taste, aroma, and color.

Mixture Design (MD) in Design Expert (DX) 7.0 program was used to optimize formula. The input data required for DX 7.0 were test variables and level range of each variable. The results of preference test were used as response. This step was applied to find the optimum formula through multivariate equation. This multivariate equation was mapped in both contour plot (2-D) and surface plot (3-D).

Analysis of reformulated GTD

Physicochemical analysis: Physicochemical analysis included proximate tests (water, ash, crude fat and protein contents) [7], sugar content analysis by Luff Schoorl method [8], color measurement by Hunter method [9], and pH value.

Sensory evaluation by hedonic-test [10]: Hedonic test was

carried out to evaluate sensory characteristics of product in several stages of research, i.e. product optimization, consumer acceptability and preference test. In product optimization, subjects were instructed to taste the samples and rank their aroma and test on the basis of line scale ranging from 0 (dislike extremely) to 8 (like extremely). The respondents were also asked to consume neutralizer prior to taste next sample.

In acceptability and preference test, subjects were instructed to taste samples and rate their aroma and taste on the basis of a 5-hedonic scale from 1 = dislike very much to 5 = like very much. The samples (selected GTD and commercial *bajigur*) were served in a hot condition.

Consumer acceptability and preference test: In this experiment, acceptability and preference test was conducted using survey method [6] combined with sensory (hedonic) test as mentioned above. The collected data included primary data obtained from the questionnaire using a written interview and the result of sensory test.

In this stage, the validated questionnaire was used, with a slight modification in product terminology. The respondents were untrained panelists and consumed GTD at least once in the last two months. The data from acceptance and preference test were then statistically evaluated using Fishbein and *Wilcoxon* method in SPSS 13.0 software.

Results and Discussion

GTD Preference

Initial preference analysis of GTD was performed to determine a GTD candidate for reformulation. GTD demonstrating the highest score in each category was selected. The category was based on GTD consumption frequency in a week, the amount of GTD consumed in each serving, ethnic difference, and gender. The results showed that *bajigur* was selected as the most preferable GTD and therefore, its formula was optimized in further step. Based on the four selection categories, *bajigur* conformed to three selection categories, while *sekoteng*, *bir pletok*, and *sarabba* only conformed to two and one selection category, respectively.

The result of total preference percentage (by ignoring the ethnic differentiation) also supported *bajigur* as the selected GTD to be optimized further. In term of number of respondents, the best preference was attributed to *bajigur* with 12 respondents (30%), *sekoteng* and *bandrek* with each 8 respondents (20%), *wedang jahe* and *sarabba* with each 5 respondents (12.5%) and *bir pletok* with 2 respondents (5%).

Fishbein (e_i) evaluation score test was also performed in this preference step, enabling to guide better formula optimization. Evaluation score data (e_i) of the selected GTD (*bajigur*) could be seen in Table 1. Two types of product attributes included internal (aroma, umami, sweet, ginger pungency, and color) and external (easy-to-get, served hot). Based on evaluation score data (e_i), all attribute scores were positive which indicated that the attributes were considered important for *bajigur*. Among them, the pungency of ginger with 1.17 e_i score was considered as the most important attribute by consumer.

No.	*Bajigur* Attributes	Average evaluation score (e_i)
1	Aroma	0.92
2	Umami taste	0.5
3	Sweetness	0.67
4	Pungency (ginger)	1.17
5	Color	0.83
6	Easy-to-get	0.58
7	Served hot	1.08

Table 1: Evaluation score (e_i) towards every *bajigur's* attributes in ginger-base traditional drink (GTD) preference analysis

Therefore, it is regarded as the main target in optimization. Moreover, based on Table 1, it could be concluded that "served hot" as external attribute should be considered as important criterion for *bajigur*.

Umami seems to be the least important by consumer for choosing *bajigur*. Hence, it might be concluded that umami was not very important for the consumer. Therefore, in the next step of this study (consumer acceptability), umami was not included in the test. Another reason for eliminating umami in the following test was to avoid bias since untrained panelists could not distinguish between umami and salty taste.

GTD Formula Optimization

GTD formula optimization was performed by mixture design approach using *Design Expert* 7.0. (DX7) program. Ingredients of GTD, including palm sugar, ginger and coffee, were included as test variables with each ingredient in its own range. Test variables were inserted with certain total amount, while the rest was a total from fixed variables (coconut milk, salt and pandanus leaf). Fixed variables were components whose composition was not changed in the formula.

In addition to optimize pungency flavor, the optimization aimed to produce optimum responses in color, sweetness and aroma. Therefore, palm sugar and coffee are also included as test variables.

Trial design using two repeated measurements without grouping consisted of 10 formulas, while the responses included average preference score of four attributes (response variable), i.e. color, aroma, pungency (ginger) and sweetness. The results of the experiment are presented in Table 2.

Each response variable was then analyzed in DX7 to get polynomial model with a suitable order (linier, quadratic, special cubic and cubic). The polynomial model was based on sequential model sum of squares [Type I], lack of fit tests and summary statistics.

As a result, DX7 offered the polynomial model with the best order for each response variable. Table 3 showed summary for attribute regarding order and model. Model with "prob>f" lower than 0.05 exhibited significant effect on the response [11]. The model with significant difference could be used as prediction model in optimization step. Based on analysis of variance (ANOVA), the resulted model for color, pungency and sweetness responses could be statistically acceptable as prediction model. Model for aroma response was not utilized further due to the negligible effect of palm sugar, ginger, and coffee on aroma.

The optimization stage also aimed not only to minimize efforts or operational cost, but also to maximize desirability [11], ranging from 0 to 1 (least to most desirable, respectively). Desirability at value of approximately 1 indicates greater probability for obtaining desirable response value [12].

Based on the trial design and evaluation data (color, sweetness and pungency score) of 10 GTD formulas, DX7 displayed suggested optimum formulas, in which the best one (formula A) was achieved at desirability of 0.668. Formula A consisted of 80% coconut milk, 11.88% palm sugar, 5% ginger, 1.12% coffee, 1.5% salt and 0.5% pandanus leaves.

The desirability values were largely influenced by component complexity, range of the components, and desired targets. The range of treatment values was relatively not large, while the desired goal was expected to reach approximately 8. Consequently, the desirability value obtained in this study only reached 66.8% (0.668).

Physico-chemical analysis

The largest chemical composition in a drink is water. According to Woodroof [13], water composition in a drink was more than 85%. As presented in Table 5, water was the most dominant component (63.05% wb) in optimum formula of GTD, although it was much lower than 85%. This may be due to the fat content and other hygroscopic components present in GTD. Harjadi [14] stated that if the water retention in the sample was high due to any absorption or chemical reaction in the sample, then water loss became low and more difficult in evaporation. This could be caused by the presence of sucrose, glucose, maltose, lactose, and hydrates from ions and polymers which enabled to generate water binding activities [15]. Water and fat content in *bajigur* mostly come from coconut milk. Hagemair [16] stated that fat content in coconut milk could reach 38%. As exhibited in Table 5, we can state that the drink appears to have normal properties with high fat content and bright yellowish brown in color.

No.	Test variable			Response Variable			
	% palm sugar	% Ginger	% Coffee	Color	Aroma	Pungency (ginger)	Sweetness
1	14	3	1	2.29	4.89	4.95	2.66
2	12	5	1	5.20	4.81	5.76	4.97
3	12.5	3.5	2	3.78	4.04	4.12	4.14
4	11	5	2	4.82	5.2	4.12	4.14
5	14	2	2	4.81	4.34	5.06	4.46
6	14	4	0	1.52	4.18	3.65	3.89
7	13	5	0	3.8	5.09	3.77	1.8
8	13	4	1	3.83	4.34	4.5	4.3
9	11	5	2	4.04	4.24	3.79	3.75
10	14	2	2	3.77	3.83	5.06	3.75

Table 2: Trial design and average score of ginger-base traditional drink (GTD) sensory attributes

No.	Response variable	Model Order	Polynomial model
1	Color	Quadratic	$Y=(-4.69)X_1+75.37X_2-185.73X_3-67.82X_1X_2+314.07X_1X_3-91.15X_2X_3$
2	Aroma	Linear	$Y = 3.84X_1 + 7.41X_2 + 2.36X_3$
3	Pungency	Special cubic	$Y=60.53X_1+549.65X_2+1246.86X_3-956.88X_1X_2-1896.43X_1X_3-5983.52X_2X_3+096.76X_1X_2X_3$
4	Sweetness	Quadratic	$Y=(-5.73)X_1+52.39X_2-108.85X_3-30.8X_1X_2+225.59X_1X_3-148.72X_2X_3$

Table 3: The chosen order model and its response variable

Response variable	Model order	Sum of squares	db	Mean square	F test	Prob>F	Significance
Color	Quadratic	10.56	5	2.11	8.49	0.0297	Significant
Aroma	Linier	0.65	2	0.33	1.74	0.2436	Not significant
Pungency	Special cubic	4.13	6	0.69	8.96	0.0499	Significant
Sweetness	Quadratic	8.22	5	1.64	22.60	0.0049	Significant

Table 4: Analysis of variance (ANOVA) of model for each response variable

Consumer acceptability and preference test

Profile of respondents: The respondent was randomly selected, although the preferable subjects are from those who experienced on consuming *bajigur* previously. This condition is needed because the GTD formula produced from the modification of *bajigur* formula.

According to Stepherd and Spark [3], gender is one of the factors influencing one's preference to certain food product. Based on gender, the respondents consisted of 60 female (60%) and 40 male (40%).

Furthermore, respondent's age was not decided, considering that *bajigur* is consumed by wide range of ages (except for infant). In fact, the age of respondents was >15 years old since they are regarded capable of filling out the questionnaire and considered to be able to give comments without external interference. Most respondents consuming *bajigur* were 36-50 years old (37%), which was slightly higher than other age groups of 20-35 years old (29%), <20 years (26%) and >50 (8%). This results suggested that *bajigur* consumers were from wide range of age.

Regarding acceptability and preference of *bajigur,* the result indicated that most respondents consuming *bajigur* were dominantly from unworked group such as students and housewife (56%), followed by civil servant (16%), employee (14%), entrepreneur (12%), and retired man (2%). Based on monthly expenditure (rupiah per month), the *bajigur* consumers were classified as follows: <500,000 (29%), 1,000,001-1,500,000 (23%), 500,001-1,000,000 (20%), 1,500,001-2,000,000 (19%) and 2,000,000 (9%).

Furthermore, most respondents consumed the drink less than once a week. The result showed that the *bajigur* consumption frequency at less than once a week was voted by 64% respondents, followed by less than 3 times a week (32%) and 3 times a week (4%). This may be linked with the unfixed location of the *bajigur* street vendors because they often moved to other places; therefore, consumers only purchased *bajigur* when they could find the vendor. This was also supported by the result of survey, demonstrating that 94% of respondents purchased *bajigur* in street vendors, while others purchased it in supermarket (4%) and small shop or *warung* (2%).

In case of amount, most respondents (69%) consumed *bajigur* at less than 250 ml, followed by 250-300 ml (29%) and 301-350 mL (2%).

Based on consumer's acceptability to reformulated GTD, we noticed that 96% of respondents could accept the modified formula of GTD, while only 4% of respondents did not accept the product. Through direct interview, we found that their unacceptability was due to the changes in taste which are not familiar with their expectation.

The consumer's acceptance and preference test in Bogor demonstrated that the optimum GTD formula could be accepted by consumers from various ethnics including Batavians, Javanese, Sumatrans, Borneo/Celebes and Sundanese. However, Sundanese seemed to be the biggest consumers (67%). In summary, the consumers of *bajigur* were female (60%) and their age was 36–50 years old (37%). Furthermore, they were also from non-working consumers (56%) and people with expenditure of <Rp. 500,000 per month (29%). Additionally, 71% of non-working consumers was female.

Fishbein multi-attribute analysis: Table 6 showed the results of Fishbein multi-attribute score (A_0). The total number of attribute score of each attribute would be a total attribute score. According to [17], the higher total attribute score of a product increased the consumer preference.

Based on Table 6, total attribute score of reformulated GTD (3.44) was higher than commercial *bajigur* (1.25). It means that respondent preferred the reformulated GTD than the commercial *bajigur*. The result of this total Fishbein attribute was in accordance with attribute score prediction (response) in formulation optimization step by using DX7. Using DX7, the optimized GTD formula was predicted to produce optimum score in respondent evaluation towards each attribute/response which is suitable with the respondent's desire.

Wilcoxon test: Table 7 showed that Batavians and Borneo/Celebes stated that no difference in preference between the two types of *bajigur*, reformulated and commercial, either in their aroma, sweetness, pungency (of ginger), color or overall attribute. In the other hand, the Javanese indicated that there was significant difference in their preference to aroma, pungency, color and overall attribute of the two GTDs. Only the sweetness attribute was found to have no difference in preference to both types of GTD.

Similar result was observed in Sundanese group. They seemed to be more familiar with *bajigur*, since this traditional beverage originated from West Java (Sunda area). The result of Wilcoxon test in Table 7 showed that the preference of all attributes was significantly different, except for aroma.

Regarding to Sumatrans, there was a difference in preference to pungency and overall attributes to both types of GTD, while there was no difference in aroma, sweetness, and color attributes.

These different preferences by ethnical groups strongly indicated the correlation between ethnical culture (or eating habit) and product's preferences. This was in line with the statement of Cardello [18], finding that sensory properties in food will be processed in the brain, which is influenced by the cultural factor.

No.	Parameters	Average value*)
1	Moisture content (% wet basis)	63.05
2	Ash content (%wet basis)	0.41
3	Protein (%)	1.47
4	Total crude fat (%)	28.32
5	Sugar content (%)	5.81
6	pH	5.96

*) average value of three repeated measurements

Table 5: Physicochemical analysis result of ginger-base traditional drink (GTD) optimum formula

| Attributes | Types of GTD | |
	A (GTD optimum formula)	B (Commercial *Bajigur*)
Aroma	0.99	0.58
Sweetness	0.81	0.34
Pungency	0.57	0.09
Color	1.07	0.24
Total	3.44	1.25

Table 6: Attribute score (A_0) of respondents to ginger-base traditional drink (GTD) optimum Formula

Ethnics	Attributes				
	Aroma	**Sweetness**	**Pungency (of ginger)**	**Color**	**Overall**
Batavians	-	-	-	-	-
Javanese	+	-	+	+	+
Borneo/Celebes	-	-	-	-	-
Sumatrans	-	-	+	-	+

+ = Significantly different, - = not significantly different

Table 7: The result of Wilcoxon test for ginger-base traditional drink optimum formula and attributes

Furthermore, most ethnics, except for Javanese, expressed that there was no difference in preference to aroma. This was in accordance with ANOVA prediction in formulation optimization using DX7 program, indicating that changes in components (palm sugar, ginger, and coffee) unaltered the preference of aroma.

The evaluation in ginger pungency attribute showed a reversed result compared to aroma attribute. The pungency preference by most ethnics to both GTD samples was recorded as significant difference. This was supported by the result of Fishbein test (Table 6). The result showed that consumer preference score to pungency of reformulated GTD was much higher (0.57) in comparison with that of commercial *bajigur* (0.09). This finding also indicated that the optimization was carried out according to respondent preferences.

Conclusion

In this present work, *bajigur* was found to be the most desirable ginger-based traditional drink by consumers compared to *bandrek*, *sekoteng*, *bir pletok*, *wedang jahe*, and *sarabba*. The ginger pungency in *bajigur* appeared as the most important attribute according to consumer evaluation.

The optimization of GTD formula based on aroma, sweetness, pungency and color produced a reformulated GTD with desirability value of 0.668. It was made of 80% coconut milk, 11.88% palm sugar, 5% ginger, 1.12% coffee, 1.5% salt, and 0.5% pandanus leaves, while its chemical composition was 63.05% moisture, 0.41% ash, 1.47% protein, 28.32% fat, and 5.81% sugar. Physically, the reformulated drink had a pH level of 5.96 and appeared in a range of red color with lightness value of 46.90 and ^{0}Hue of 48.52. GTD optimum formula could be accepted by consumers from various ethnics (Batavians, Javanese, Borneo/Celebes, Sumatrans and Sundanese). We also found that the greatest percentage of *bajigur* consumer was Sundanese (67%), while difference in ethnics also influenced preference to each *bajigur* attributes. The reformulated GTD was more preferred (3.44) by the consumers compared to commercial *bajigur* (1.25). The reformulation of GTD according to respondent's preference was achieved.

Acknowledgements

References

1. Koswara S. Jahe dan hasil olahannya. Jakarta: Pustaka Sinar Harapan;1995.

2. Yusuf RR. Formulasi karakteristik kimia dan uji aktivitas antioksidan produk minuman tradisional sari jahe dan sari sereh; 2002. Indonesia, Bogor : Institut Pertanian Bogor, BSc. Thesis.

3. Stepherd R, Sparks P. Modelling food choice. In Macfie, H. J. H. and D. M. H. Thomson. Measurement of food preference. Glasgow: Blackie Academic and Professional;1994.

4. Pasqualone A, Summo C, Laddomada B, Mudura E, Coldea TE. Effect of processing variables on the physico-chemical characteristics and aroma of borş, a traditional beverage derived from wheat bran. Food Chem. 2018 Nov;265:242-252.

5. Bergier JF. Food acceptance and cultural change some historical experiences. In Solms, J., Booth, D.A. Pangborn R. M. and O Raunhardi. Food acceptance and nutrition. San Diego: Academic Press Inc;1987.

6. Simamora B. Riset pemasaran. Jakarta:Gramedia Pustaka Utama; 2004.

7. The Association of Official Analytical Chemists (AOAC). (2004). Official methods of analysis of the Association of the Official Analytical Chemist. Washington DC, USA;1995.

8. Badan Standardisasi Nasional (BSN). Analisis gula SNI 01-2892-1992. Badan Standarisasi Nasional, Jakarta;1992.

9. Hutching JB. Food color and appearance. 2nd Edition. Gaitersburg: Aspen Publishing, Inc;1999.

10. Meilgaard M, Civille GV, Carr BT. Sensory evaluation techniques. 3rd rev. ed. Boca Raton: CRC Press;1999.

11. Anonymous. Design Expert 7.0 Tutorial. Stat-Ease, Inc;2006.

12. Montgomery DC. Design and analysis of experiments. 5th rev. ed. Singapore: John Willey and Sons;2002.

13. Woodroof JG, Frank G. Beverages: carbonated and noncarbonated. Connecticut: The AVI Pub., Corp. Inc;1981.

14. Harjadi W. Ilmu kimia analitik dasar. Jakarta: Gramedia Pustaka Utama; 1993.

15. Sudarmadji S, Haryono B, Suhardi. Prosedur analisa bahan makanan dan pertanian. Yogyakarta : Yogyakarta Liberty;1996.

16. Hagenmaier R. Coconut aqueous processing. Cebu City: University of San Carlos; 1977.

17. Schiffman LG, Kanuk LL. Consumer behavior. 5th rev. ed. Engelwood: Prentice Hall;1994.

18. Cardello AV. Consumer expectation and their role in food acceptance. In MacFie, H.J.H. and D.M.H. Thompson. Measurement of food preference. Glasgow: Blackie Academic and Professional;1994